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Focal Plane Anomalies and Effects: post Cryostat EO testing.

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This table has a list of Focal Plane anomalies and effects that may need additional Camera information and/or DM corrections. Known effects already included in DM ISR are not necessarily included.

Effect	Description	Links	Additional Data, Study or Code Needed
Bias Structure & Bias Variability	1. Bias shows rapid changes in value in either serial or parallel directions, making spline fitting difficult/impossible 2. Bias level and shape varies from image to image in both Serial & Parallel directions		1. PCA-based Serial+Parallel overscan correction method works, but probably could use refinement and needs implementation in DM 2. S+P overscan correction works well for most channels, but a number of e2v channel have remaining 2-D bias variability, for which only pre-scan pixels have relevant information RHL: both easy enough to implement, although we'll have to determine the proper lookup for PCA functions (e.g. are they fixed? Are they a function of other parameters which we'd need to include?)
Temporal REB (Raft Electronics Board) Electronic Gain	1. Gain in some ITL channels has a bi-modal response, with ~0.05 % difference between lo and hi states. Response in lo or hi band appears random, but occurs for all or half of channels in a CCD		1. Gain Stability calibrations to determine relative response of lo/hi bands 2. If needed DM code at catalog-level to determine lo/hi response RHL: Would the DM code look for camera-based spatial structure in the apparent throughput on the sky

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			(as the absolute gain is degenerate with transmission)? Or are you thinking of CBP measurements?
Temperature-dependent REB Electronic Gain	1. REB Electronic Gain has a ~0.06%/C temperature coefficient		1. Calibration constants - slope and intercept - for each REB. Gain Stability Runs had sufficient temperature variation to determine these. 2. ISR code to apply simple correction RHL: easy enough if we have access to the RTDs in the metadata. This will require some slightly-deeper changes as we try to avoid using numbers straight from the headers, but unpack them first. Not a big deal.
Full Well	1. Different definitions of Full Well yield different values. PTC Turnoff (where the PTC Variance vs. Signal curve leaves the linear+B-F correction dependence) vs. Linearity Turnoff (where Signal vs. PhotoDiode leaves a linear dependence) vs. Maximum ADU vs. PSF Turnoff (where star's PSF shows non-B-F distortions 2. Full Well may also be location dependent inside a CCD Amplifier section		1. Different aspects of Full Well may require different treatment for pixels or objects. RHL: this sounds scary! What exactly do you mean? 2. PSF Turnoff from I&T Spot data in 4 sensors, compare to PSF-Turnoff. Likely needs serial CTI corrections implemented. 3. PTC-Turnoff is implemented in DM PTC-Task. A PSF-Turnoff measure would need DM code post PSF characterization to evaluate in each amplifier. RHL: I expect that the saturation levels will be known before PSF-determination. For exploratory analysis we can of course turn

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			this off, or comparisons like psf - aperture flux (usually used for star/galaxy separation) are pretty good at finding the onset of bleeding. If we want to use the PSF, I'd probably look at the residuals from PSF-subtracted frames – that'd work even with a PSF model built from "safe" stars
Non-linear Cross-Talk	1. Cross-Talk coefficients depend on Source signal level. Non-linearity present for all coefficients		1. Cross-talk coefficient determination and correction needs to include nonlinear signal dependence. 2. I&T Cross-talk evaluation will supply an initial determination of Crosstalk vs Signal for a sample (4) of CCDs, using both spots and streaks. RHL: Easy enough for DM to implement once the coefficients are known. We need to decide if we'll need to track this effect in time using the CBP and/or on-sky data; if so, the coefficient-determination code needs to be ported to DM
Persistence	1. Saturated pixels have small persistence signal with long (17 second) time-constant		1. Camera characterization of effect, especially to determine at what signal it begins (ie. at Full Well? which Full Well?) will be done 2. Correction algorithm, using multiple prior images & time constant, needed. RHL: This has major DM consequences, as it introduced the need

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			to maintain a history (which means that we can't rearrange the processing DAGs) or read *much* more data per exposure. I don't think it'll impact the prompt processing, but if it does it'll be even more serious.
Tree-Rings	1. Tree-Ring distortion of astrometry & PSF		1. Flat-field characterization of Tree-Rings as f(r) with centers r_CCD. 2. Astrometry and WCS corrections from f(r) 3. Note that for WCS this assumes that pixel size/shape is constant over the object. This assumption may require further study. RHL: I don't understand the scope here. Do we need to do this in the lab, or on the sky as part of the full astrometric analysis where GAIA makes things relatively easy (as the atmosphere will beat down as sqrt(t) or sqrt(N))? Are we confident that there won't be other geometric effects (à la epoxy in DECam and HSC) in addition to tree rings and the edge/bleed stop distortions? In other words, is the f(r) analysis going to be sufficient?
Pixel size or Drift E field	1. Midline break & implants and Edge effects		1. Flat field characterization. 2. Decision about pixels to use/excise 3. Astrometry & WCS corrections. Are these made in the

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			same way as Tree-Rings? RHL: See notes in previous row. I'm not sure that the decision is something we need to make now, rather than in the context of on-sky data. The representation of the distortions is a DM decision (as it has to run in the guts of the astrometric solver, which is going to be based on gbdes so the representation will probably be familiar to DES folk)
Divisadero Effect	1. Drop in response at Amplifier boundaries in e2v CCDs		1. Effect is < 0.5% in almost all CCDs. Is any correction/masking needed? 2. If correction is needed, development of correction method requires study with both Flats and Stars RHL: What does, "< 0.5%" mean? Number of pixels? Amplitude of variation in the gain? Jump in background level? I think we need to study this jointly with DM
Serial CTI	1. Pockets in serial register in ITL channels, causes anomalous serial CTI		1. Correction algorithm developed, being implemented in DM ISR now 2. Test via B-F correlations and PTC
Parallel CTI	1. Early onset large Parallel CTI, causing dip in PTC variance before PTC-Turnoff		1. Characterization of effect still needed
Differential Nonlinearity	1. Significant differential non-linearity, or ADU		1. Study is ongoing to determine if any correction is

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	bias, is observed, especially in the 4's bit.		needed, indications are that none may be necessary. RHL: I assume that this study includes correlations such as those presented in Boone et al.
Non-functional Channel Tracking	1. in 2020 there were 2 channels which transitioned from Good→Bad and Bad→Good. Track list of non-functional channels, in case these change state again.		1. Maintain non-functional channel list RHL: DM needs to handle this list too. It's made harder for us by some missing camera functionality that's to be in TBD.
Bias Shifts	1. Bias level jumps after saturated objects. Effect has been mitigated by lowering the electronic gain (ADU/e-) (NOTE: Gain usually reported as \[e-/ADU\])		1. Further study with structured images to verify that the effect is fully mitigated. RHL: do we need to monitor this on Cerro Pachón?

No labels